

Confirmation of the presence of the fern species: *Lepisorus schraderi* (Mett.) Ching in Reunion island (Polypodiales: Polypodiaceae)

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ABSTRACT: Reunion Island (Mascarene Archipelago, Indian Ocean) belongs to one of the thirty-four world biodiversity hotspots. On this island, where approximately 250 species of Pteridophytes were recorded, the presence of *Lepisorus schraderi* (Mett.) Ching is confirmed for the first time. Only, one population of this fern was located in a mountain forest near the Piton de la Fournaise volcano. As *L. schraderi* could be confused with *L. excavatus* (Bory ex Willd.) Ching also present on the island, this paper provides a key to identify correctly *L. schraderi* and *L. excavatus*, using morphological characters, as well as cytologic methods.

RÉSUMÉ: La présence de *Lepisorus schraderi* (Mett.) Ching (Polypodiaceae) est confirmée pour la première fois sur l'île de La Réunion. Les caractères morphologiques et cytologiques permettant de distinguer les deux espèces réunionnaises de *Lepisorus*, *L. schraderi* et *L. excavatus* (Bory ex Willd.) Ching, sont précisés.

KEYWORDS: *Lepisorus schraderi*, Pteridophytes, Reunion island, Mascarene, chromosome numbers

MOTS CLÉS: *Lepisorus schraderi*, Ptéridophytes, La Réunion, Mascareignes, nombres chromosomiques

INTRODUCTION

The studies on Pteridophytes species from Reunion island reveal regularly some new details. For example, recently, ROBERT (2011) showed that *Christella parasitica* (L.) Lév. ex Holttum is a new native fern. DUBUISSON *et al.* (2014) also described a new endemic variety: *Crepidomanes inopinatum* (Pic. Serm.) J.P. Roux var *tamonii* Y. Robert & Dubuisson.

Lepisorus (J. Sm.) Ching is a fern genus including approximately 40 species (HENNIPAN & *al.*, 1990; ZINK, 1993), mainly distributed in the Sino-Himalayan region. Around six *Lepisorus* species were observed in the Afro-Malagasy region including the Mascarene islands. A single one is present in the Hawaiian archipelago. WANG *et al.* (2012) showed that the Afro-Malagasy species result from a rapid radiation which began around 1.5 My ago from an ancestor native to the South-West of China.

There are three species in the Malagasy region (TARDIEU-BLOT, 1960; ROUX, 2009): *Lepisorus excavatus* (Bory ex Willd.) Ching, *Lepisorus schraderi* (Mett.) Ching and *Lepisorus perrierianus* (C. Chr.) Ching. *L. excavatus* and *L. schraderi* are present in Madagascar, in tropical and southern Africa while *L. perrierianus* is endemic to Madagascar. Hitherto, a single species, *L. excavatus* was known on Reunion island (CORDEMOY, 1891; TARDIEU-BLOT, 1960; BADRÉ, 2008; ROUX, 2009).

It should be noted, however, that preliminary works conducted by the botanist Th. Cadet mentioned the presence in Reunion island of a plant identified by F. Rakotondrainibe as *L. schraderi* (Grangaud, *comm. pers.*). A voucher specimen (*Cadet 3189*) classified in Cadet's Herbarium is preserved at the Reunion University Herbarium (REU). Th. Cadet collected this species in *Acacia heterophylla* (Lam.) Willd. forest over the « Rivière de l'Est » bottom near the Piton de la Fournaise volcano.

This work provides the confirmation of the presence of *L. schraderi* on Reunion island. The comparison between *L. schraderi* and *L. excavatus* (*Tab. I*), the local and worldwide distribution as well as the cytology of *L. schraderi* and the threats against this fern into its environment are described in this paper.

MATERIALS AND METHODS

A specimen of *L. schraderi* was collected in *Acacia heterophylla* forest over the « Rivière de l'Est » bottom near the Piton de la Fournaise volcano as it was done by Th. Cadet.

A specimen of *L. excavatus* was collected in Jean Maurice Tamon's garden, located at the Plaine des Palmistes .

The collected samples allowed to determine the chromosome number of both *L. schraderi* and *L. excavatus* by using GIBBY method (1985) which has been adapted by ROBERT (2014).

MATERIAL EXAMINED:

REUNION ISLAND: Commune de Sainte Rose, rempart de la rivière de l'Est near the Piton de la Fournaise volcano, alt. 1 900 m, 26/03/1971, *Cadet 3189* (REU).

NOMENCLATURAL ASPECT:

- *Lepisorus schraderi* (Mett.) Ching in Bulletin of the Fan Memorial Institute of Biology 4, 3: 51. 1933b.
- *Polypodium schraderi* Mett. in Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft 2, 1: 98, pl. 2, fig. 11. 1856b. Type: "Prom. b. spei", C. H. F. Hesse s. n. (LE. holo.).
- *Niphobolus schraderi* (Mett.) Keyserl., Polypodiaceae et Cyatheaceae herbarii bungeani: 39. 1873.
- *Polypodium lineare* Thunb. var *schraderi* (Mett.) Sim, Handbook of the ferns of Kaffraria: 52, pl. LVI. 1891, nom. nov. for *Polypodium elongatum* Schrad. (1818: 915).
- *Pleopeltis schraderi* (Mett.) Tardieu in Flore de Madagascar et des Comores, 5^{ème} Famille-Polypodiacees (sensu lato) [5(11) Blechnacees-5(14) Polypodiacees (sensu stricto)]: 110. 1960a.
- *Polypodium elongatum* Schrad. in Göttingische Gelehrte Anzeigen (1818: 915), non Aiton (1789: 465), nom. superfl. [McNeill et al. (2006) Art. 53. 1]. Type: South Africa, Grahamstown, C. H. F. Hesse s. n. (LE. holo.).
- *Phymatodes elongata* (Schrad.) Pappe & Rawson, Synopsis filicum Africae australis: 41. 1858, nom illeg. [MacNeill et al. (2006) Art. 53.1], non (Kaulf.) C. Presl. (1836: 196).
- *Polypodium gueinzii* Mett. in Abhandlungen herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft 2, 1: 91, pl. 3, figs 18, 19. 1856b, as "*gueintzii*". Type: "Ad portum Natalensem lectum", W. Gueinzus s. n. (LZ, Holo. B, S, ? iso.).
- *Polypodium lineare* Thunb. var *gueinzii* (Mett.) C. Chr., Index filicum: (540: 1906). - *L. gueinzii* (Mett.) Ching in Bulletin of the Fan Memorial Institute of Biology 4, 3: 51 1933b, as "*gueintzii*".

LIST OF EXSICCATA FROM REUNION ISLAND (IN YANNIS ROBERT PRIVATE HERBARIUM):

Lepisorus schraderi: Sainte Rose, rempart de la Rivière de l'Est near the Piton de la Fournaise volcano, 13/05/2014, Robert 1701.

Lepisorus excavatus: Plaine des Palmistes, Jardin de Jean Maurice Tamon, 11/07/2014, Robert 1779.

RESULTS

L. schraderi was found in the « Rivière de l'Est » bottom near the Piton de la Fournaise volcano at an altitude of 1 700 to 1 900 m. It grows among the native vegetation on the rim over the excavation where the river begins. This fern is an epiphyte growing on several trees or shrubs such as *Acacia heterophylla*, *Sophora denudata* Bory, *Claoxylon glandulosum* Boivin ex Baill., *Dombeya ficulnea* Baill. It is usually found with two other Polypodiaceae: *L. excavatus* and *Pleopeltis macrocarpa* (Bory ex Willd.) Kaulf. Its presence closer to these last two species could explain why this new species was not detected earlier because of the possible confusion. Moreover, a broad similarity with a fourth species belonging to the same family: *Belvisia spicata* (L. f.) Copel could also noted. The confusion is more likely when, under bad water conditions, *B. spicata* has not its fertile ear. Indeed, *L. schraderi* and *B. spicata* can withstand water stress by keeping a strong desiccation during drought period and can be revitalized when rains return.

Our countings gave for *L. excavatus* $n = 36$ (Fig. 1a) and for *L. schraderi* $n = 72$ (Fig. 1b) this last result constitutes a first record. Thus, *L. excavatus* would be diploid while *L. schraderi* would be tetraploid by taking as basic chromosome number $x = 36$ in accordance with WANG *et al.* (2011).

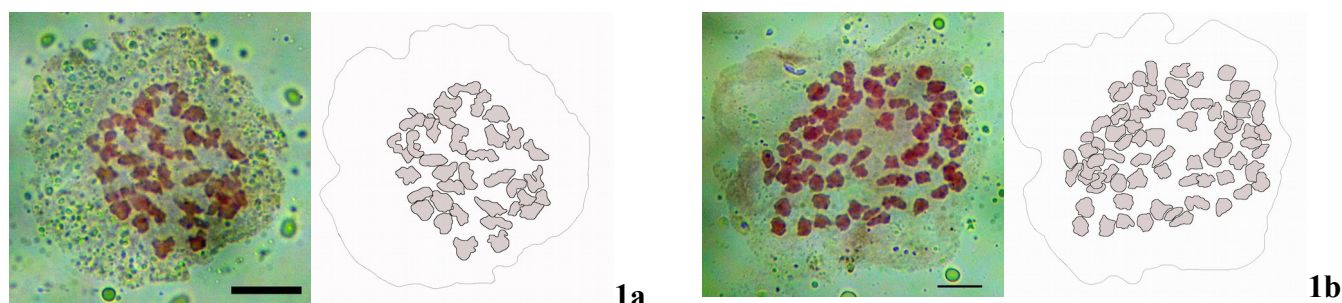


Figure 1. – *Lepisorus* spp. : 1a) *L. excavatus*, YR 1779: Microphotography and drawing of meiosis showing 36 bivalents; 1b) *L. schraderi* YR 1701: Microphotography and drawing of meiosis showing 72 bivalents.
Scale bar = 10 μ m

DESCRIPTION OF *L. SCHRADERI* (FIG. 2).

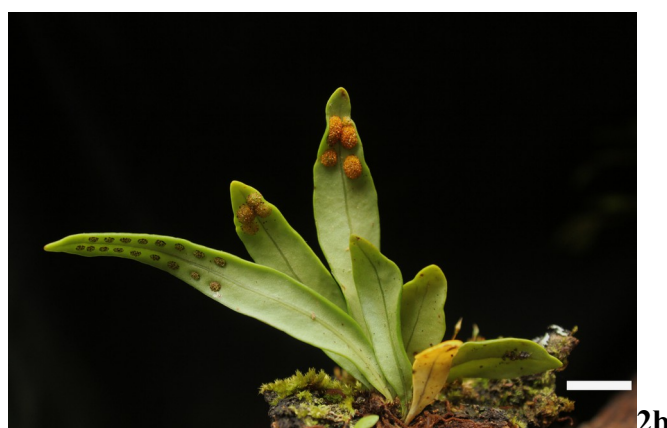
Rhizome shortly creeping, 2-3 mm in diameter, bearing black scales, peltate, lanceolate to ovate, acuminate. Frond tufted, evergreen. Stipe short, glabrous or sometimes with few scattered scales (Fig. 2a). Lamina narrowly lanceolate, gradually attenuate towards the acute apex, base decurrent on the very short stipe, simple, texture thick and fleshy, both sides glabrous at maturity, margins entire. Sorus round, arranged in two rows in distal third to half of the lamina (Fig. 2b); with small peltate paraphyse when young.

Table I. – Comparison between *L. schraderi* and *L. excavatus*

Plant parts	<i>L. schraderi</i>	<i>L. excavatus</i>
Rhizome :		
- Diameter	2 - 3 mm	More than 5 mm
- Scales	black	brown
- Waxy coating	none	present
Lamina		
- Texture	fleshy	membranous
- Abaxial side	glabrous or with few scattered scales	glabrous
Cytology	Tetraploid (n = 2x = 72)	Diploid (n = x = 36)



2a



2b

Figure 2. – *Lepisorus schraderi*, 2a) Short stipe with scattered scales on costa; 2b) Whole plant showing sorus in the distal third part of the frond (photographed by Fred Henze). Scale bar = 1 cm

DISCUSSION

L. Schraderi was observed only in the hygrophilous mountain forests [Code Hab. : 49.31], located over the « Rivière de l'Est » bottom near the Piton de la Fournaise volcano at an altitude of 1 900 m, exactly in the *Acacia heterophylla* forest [Code Hab. : 49.314]. WANG *et al.* (2012) related a sample collected in Bébour forest by Ronnald Viane (RV8253) in 1999, identified as *L. schraderi*. However, Ronnald Viane (*comm. pers.*) confirmed that a part of his collection, realized in 1999, preserved in its personal herbarium, corresponds to *L. excavatus*. In the paper of WANG *et al.* (2012), that would be probably, either a misidentification, or a confusion with a sample from another country.

L. schraderi is present in Madagascar, in Southern and tropical Africa: Ethiopia, Kenya, Malawi, Mozambique, Rwanda, South Africa, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe. In those areas, *L. schraderi* is found in high altitude such as in Reunion island. CROUCH *et al.* (2011) specify that in South Africa at the Cape Province, this species can be found until to 2 300 m of altitude. It is then much smaller, lithophyt and can easily be confused with *Grammitis poeppigiana* (Mett.) Pic. Serm. which is another Polypodiaceae present in this region.

In Reunion island, *L. schraderi* would be present only in the *A. heterophylla* forest located at the « Rivière de l'Est » bottom near the Piton de la Fournaise volcano. This forest offers an important floral diversity with numerous protected or endangered species. But, this particular vegetation is submitted to fire risks in relation with human activities (Fig. 3a), and to the occurrence of cattle in this part of the Reunion National Park (Fig. 3b). Thus, precautionary measures are needed for the protection of *L. schraderi* and more generally of the whole local vegetation.

CONCLUSION

The substantial prospecting work realized by Th. Cadet continues today to serve as the basis of the studies on Pteridophytes flora in the Mascarene Islands. The present work allowed to add *L. schraderi* to the other ferns from Reunion island. However, real threats exist about both the single population of this taxon and the Reunion highlands which are yet well known as rich biodiversity reservoirs. Local authorities have to control the human activities in order to preserve this exceptional habitat in a sustainable way.

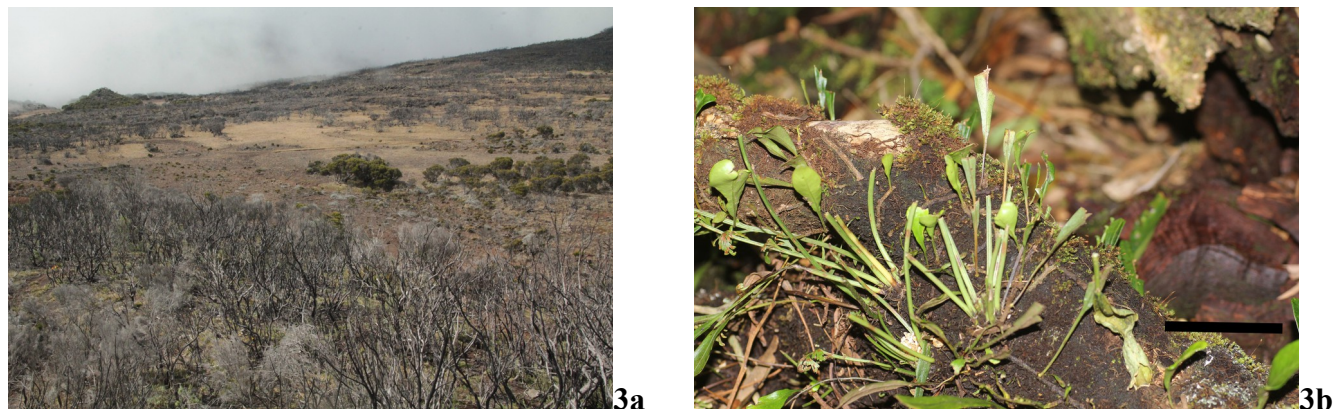


Figure 3. – 3a) Photography of a volcano area after fire; 3b) Photography showing predation of Polypodiaceae by cattle in the area of *L. schraderi*. Scale bar = 10 cm

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